

REMARKS

In view of the above amendments and following remarks, reconsideration and further examination are requested.

Initially, replacement formal drawings for Figs. 10-13 have been provided so as to designate these figures as --Prior Art--.

The specification and abstract have been reviewed and revised to make editorial changes thereto and generally improve the form thereof, and a substitute specification and abstract are provided. No new matter has been added by the substitute specification and abstract.

Claims 1-14 have been canceled, and claims 15-29 have been added. New claims 15-29 have been drafted taking into account the 35 U.S.C. § 112, second paragraph, issues raised by the Examiner, are believed to be free of these issues, and are otherwise believed to be in compliance with 35 U.S.C. § 112, second paragraph. With regard to the Examiner's objection to use of the phrases "first retreat height position higher than the first height position" and "second retreat height position higher than the second height position", the Examiner's attention is respectfully directed to Fig. 3, page 41, lines 8-18, and the description of Figs. 5A-5E on pages 49-54 of the original specification, from which it is believed to be clear what is intended by the aforementioned phrases.

The instant invention pertains to a substrate transportation apparatus, a component mounting apparatus including the substrate transportation apparatus, and a method of using the substrate transportation apparatus for transporting substrates in a component mounting operation. Specifically, the substrate transportation apparatus is for transporting substrates by feeding the substrates to a mounting unit which is to mount components onto the substrates and offer the substrates as component-mounted substrates, and by discharging the component-mounted substrates from the mounting unit. Such substrate transportation apparatus is generally known in the art, but suffers from drawbacks as expressed on pages 1-8 of the original specification. Applicants have addressed and resolved these drawbacks by providing a unique transportation apparatus and method for its use.

Specifically, with reference to Figs. 2-6, for example, the inventive transportation apparatus comprises a loader unit 32 for loading a substrate along a substrate-transportation direction such that the substrate becomes positioned at substrate position P1, an unloader unit 34 for unloading from substrate position P4 a substrate positioned thereat, a substrate feed holder 36 for releasably holding the substrate positioned at substrate position P1 and then transferring this substrate to substrate position P2, a substrate discharge holder 38 for releasably holding a substrate positioned at substrate position P3 and then transferring this substrate to substrate position P4, a holder moving unit 40 for moving the substrate feed holder and the substrate discharge holder separately in a vertical direction and in an integrated state along the substrate-transportation direction, and a substrate holding-and-moving device 28 for releasably holding a substrate. The substrate holding-and-moving device 28 is capable of moving, while holding the substrate, to a substrate mounting region P0 of a mounting unit for mounting of a component onto the substrate, and also to substrate position P3, and the substrate holding-and-moving device is also capable of moving to substrate position P2.

New claim 15 is representative of the inventive substrate transportation apparatus, new claim 23 is representative of a component mounting apparatus including the substrate transportation apparatus, and new claim 25 is representative of a method of transporting substrates by using the substrate transportation apparatus.

Claims 1-14 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Barringer et al. Barringer et al. is not applicable to the newly added claims for the following reasons.

Each of the independent claims requires a first feature of the feed substrate holder and the discharge substrate holder being associated with one another such that they move as an integrated unit in the substrate-transportion direction, while being individually moveable in a vertical direction. In this regard, each of claims 15 and 23 recites,

a holder moving unit for moving said substrate feed holder and said substrate discharge holder separately in a vertical direction and in an integrated state along the substrate-transportation direction.

Similarly, claim 25 recites

positioning said substrate, while held by said substrate feed holder, at a height position above said second substrate position, and positioning a substrate discharge holder at a height position above said third substrate position, **by moving said substrate feed holder and said substrate discharge holder separately in a vertical direction and moving said substrate feed holder and said substrate discharge holder in an integrated state along said substrate-transportation direction.**

Additionally, each the independent claims requires a second feature of the substrate holding-and-moving device being for holding a substrate (Fig. 5D for example) and moving this held substrate, as a component mounted substrate to a position at which it is to be transferred to the substrate discharge holder (Figs. 5B and 5C, for example). In this regard, each of claims 15 and 23 recites

a substrate holding-and-moving device for releasably holding a substrate, **said substrate holding-and-moving device capable of moving, while holding the substrate, to a substrate mounting region** of the mounting unit, for mounting of a component onto the substrate, **and also to the third substrate position**, and said substrate holding-and-moving device also capable of moving to the second substrate position.

Similarly, claim 25 recites

moving said substrate holding base, which is holding a component-mounted substrate in said substrate mounting region, to said third substrate position;

discharging said component-mounted substrate from said substrate holding base...

moving said substrate holding base to said second substrate position;

feeding said substrate to said substrate holding base by moving said substrate feed holder downward and releasing said substrate from said substrate feed holder; and

moving said substrate holding base to which said substrate has been fed to said substrate mounting region.

The significance of these features is as follows.

In the prior art, when a component mounted substrate is moved by the substrate discharge holder to the unloader unit (Fig. 12C), a movement speed of the substrate discharge holder is limited to being low so as to prevent a mounted component from being displaced from its mounted position on the substrate by vibration resulting from such movement. This speed limitation translates into a corresponding speed limitation of the substrate feed holder since these holders are moved in an integrated state along the substrate-transportation direction. Therefore, a problem arises in that stoppage time of a mounting operation is prolonged.

Thus, according to the present invention, after the component-mounted substrate moved to the third substrate position by the substrate holding-and-moving device is delivered from the substrate holding-and-moving device to the substrate discharge holder, the substrate discharge holder is not moved while the substrate holding-and-moving device is moved to the second substrate position so as to be able to receive a new substrate at the second substrate position. Eventually, an operation which is executed thereafter (i.e. moving the new substrate to the substrate mounting region by the substrate holding-and-moving device), and transferring the component-mounted substrate to the unloader unit by the substrate discharge holder, may be performed in parallel without being influenced by each other, whereby the aforementioned problem is solved.

Barringer et al. discloses an apparatus and method for testing flexible circuit substrates. Though the Examiner has not specifically identified that structure in Barringer et al. which corresponds to the claimed substrate feed holder and substrate discharge holder, it is believed that vacuum plenum 220 corresponds to one of these holders, and that vacuum plenum 64 corresponds to the other of these holders. However, vacuum plenum 64 and vacuum plenum 220 are not associated with one another so as to move in an integrated manner, as claimed, whereby the problem with which the instant invention is concerned is non-existent in Barringer et al.

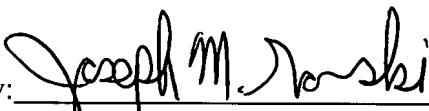
Thus, claims 15-29 are allowable.

In view of the above amendments and remarks, it is respectfully submitted that the present application is in condition for allowance and an early Notice of Allowance is earnestly solicited.

If after reviewing this Amendment, the Examiner believes that any issues remain which must be resolved before the application can be passed to issue, the Examiner is invited to contact the Applicants' undersigned representative by telephone to resolve such issues.

Respectfully submitted,

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